ENABLING THE OBJECTIVE FORCE

Dr. A. Michael Andrews II, Dennis R. Schmidt,
and Dr. Thomas Killion

"As technology allows, we will begin to erase the distinctions between heavy and light forces"
—The Army Vision

Introduction

On June 13, 2001, the Secretary of the Army and the Army Chief of Staff issued the following joint statement to the Senate Armed Services Committee: "The Army must transform itself into a force for the 21st Century, strategically responsive and dominant at every point on the spectrum of military operations, and be prepared to meet a growing spectrum of requirements including threats to our homeland." The transformed Army will dominate across the full spectrum of operations and have the agility and versatility required for rapid transition along that spectrum—from humanitarian assistance to major theater war—without loss of momentum.

The goal of the Army's science and technology (S&T) community is to provide technical solutions for the Army's transformation into a 21st century force. The objective force will fulfill the capabilities stated in the Army vision, and it will be strategically responsive, versatile, agile, lethal, survivable, and sustainable. Figure 1 illustrates objective force environments across a full spectrum of missions.

The pace of implementing the objective force may well be determined by technology's ability to provide materiel solutions that provide combat overmatch in lighter-weight forces that can enable future battle concepts. The Army's S&T investments are, in fact, key to accelerating these concepts. The S&T community will enable Army transformation efforts by focusing on investments to increase the number of leap-ahead technology options essential for the objective force.

The primary challenge is to develop and mature technologies that will eliminate current distinctions between heavy- and light-force capabilities. Heavy forces must become lighter, and light forces must become more lethal and mobile. This objective force must also be more survivable, with overmatching agility, while simultaneously reducing logistics demands. In its transformation, the Army is striving to move from platform-centric to network-centric warfare. Key to this transition are multifunctional weapon systems integrated with multitiered command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities to provide a robust "system-of-

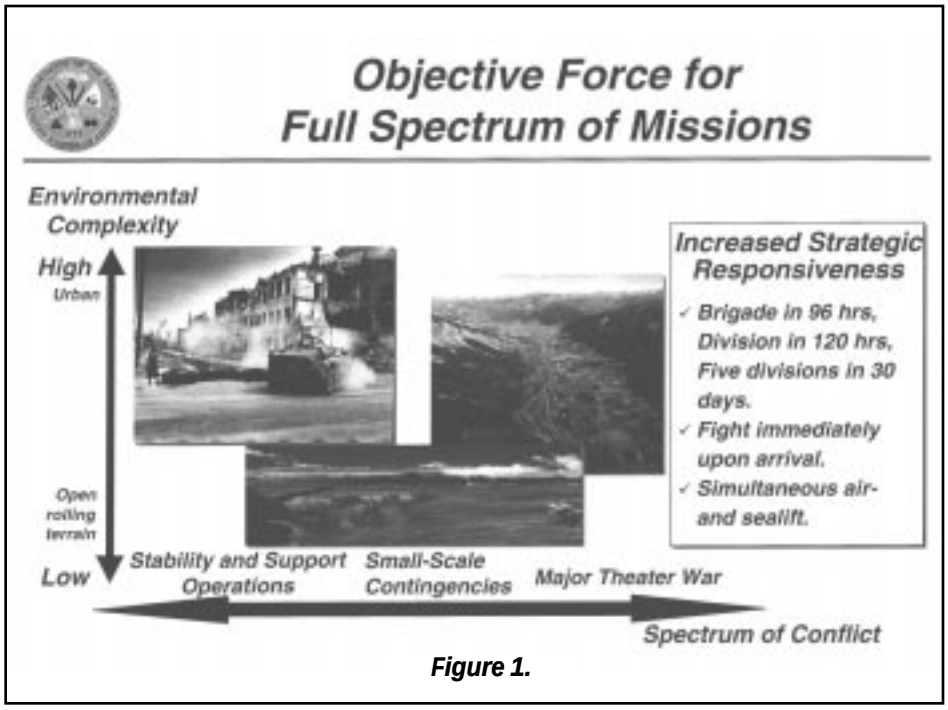

Figure 1.

systems." As always, the soldier is the fundamental "building block" of objective force capabilities.

Technology Areas

Major objective force technology areas are depicted in Figure 2 in bands roughly proportional to levels of investment. These technology areas are discussed below.

Future Combat Systems (FCS). FCS is the main thrust of S&T initiatives and represents about one-third of all S&T funding. In the Army's quest for true innovation, it has partnered with the Defense Advanced Research Projects Agency (DARPA) to explore innovative concepts for a future system-of-systems capability. Four FCS design/concept contracts were awarded in May 2000. Design teams are working closely with the Army Training and Doctrine Command and Army laboratories and centers to harmonize concept and technology developments. Emerging technology concepts include organic overhead sensors, ground and air robotics, and integrated networked communications, sensors, and fires. FCS is not a single system or platform. It will be an ensemble of fighting capabilities that meet weight and volume constraints required for transport on a C–130 or similar aircraft. Achieving FCS goals will enable a true paradigm shift, perhaps as significant as development of the machine gun, tank, and helicopter.

Basic Research. This technology area includes investments in the exploration of fundamental phenomena that have significant potential to enhance future land-warfare capabilities. Research areas include armor materials by design, nanoscience, biomimetics, compact power, smart structures, miniature and multifunctional sensors, and soldier performance.

C4ISR. This area includes investment in research and technology to enable comprehensive situational awareness for the objective force. Some C4ISR technologies are advanced sensors and sensor processing; intelligence and electronic warfare systems and techniques; militarized and special-purpose electronics; countermine technologies; and command, control, communications, and computers (C4) system technologies.

Lethality. This area includes investment in lethality technologies to enhance the light forces, such as the Line-of-Sight Anti-Tank system and the Precision Guided Mortar Munition. Also included are investments in technologies to provide lethality options for the objective force, such as the electromagnetic gun and tactical high-energy laser.

Medical. This area includes research and technology investments to protect and treat warfighters, ensure worldwide deployability, increase warfighter availability, and reduce casualties and loss of life.

Future Warrior. This area addresses investment in technologies to support the future infantry soldier. It includes enhanced ballistic protection, clothing and equipment, dismounted warrior C4, compact power and power management, sustenance and nutritional enhancements, soldier weapons, and warrior technology integration.

Rotorcraft. This investment area provides for research and technology to enhance the performance and effectiveness of future rotorcraft, including rotors and structures, propulsion and drive systems, avionics and weapons, and human-systems integration (e.g., crew station) technologies.

Logistics Reduction. This area includes investment in technologies to enhance deployability and reduce logistics demand. Some examples are precision roll-on/roll-off air delivery technologies for airfields and pavements to support force projection; the 21st century truck; and robotics to support resupply and reduce demand for food, fuel, and water.

Survivability. These technologies enable organizations, platforms, and soldiers to avoid detection, apprehension, hit, penetration, and kill. Survivability technologies also provide force protection for combat forces in the field and at installations.

Personnel Technologies. This area includes investment in advanced training tools and methods to enhance warfighter and commander abilities and performance, advanced human engineering concepts to ensure human-system physical compatibility, and cognitive engineering concepts to avoid information overload and optimize task allocation to enhance warfighting effectiveness.

Advanced Simulation. This area includes investment in simulation tools to provide increasingly realistic environments and systems to support acquisition, requirements, and training. These include technologies for networked simulations, embedded training, constructive simulations, virtual

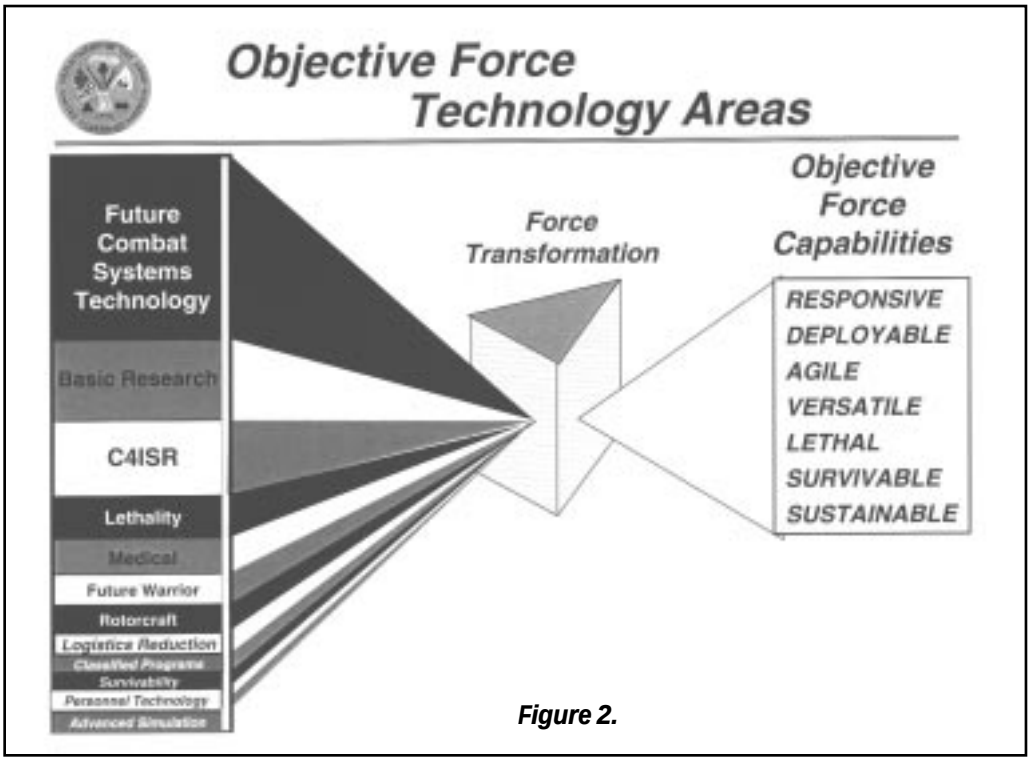

Figure 2.

environments, and range systems for live use.

Emerging Opportunities

Emerging technology concepts, including ground and air robotics and integrated systems, are described in the following paragraphs.

Unmanned Ground Vehicles. The Army S&T community is aggressively pursuing the development of robotic ground systems. The goal is to achieve increasing levels of autonomy to reduce the dependence on man-in-the-loop operations. For the near term, we are conducting a robotic follower demonstration. In the midterm, we are maturing higher-risk, semiautonomous systems through improved perception and control technology that will expand the envelope of mission capabilities. For the far term, we are collaborating with DARPA to explore advanced technology options that will increase mobility and enhance onboard intelligence to enable near-autonomous operations.

Unmanned Rotorcraft. We are speeding the development of new technology concepts for rotary-wing unmanned aerial vehicles that can hover and operate at very low altitudes (environments relevant to land-force operations). These technologies have the potential to permit the FCS and its associated dismounted elements to operate in complex terrain by exploiting organic, non-line-of-sight fire capabilities through remote sensing and communications relays. Additionally, the S&T community is exploring innovative options for unmanned combat-armed rotorcraft to enhance manned attack helicopter capabilities.

Institute For Creative Technologies. We are exploring state-of-the-art simulation technologies at the Army's Institute for Creative Technologies at the University of Southern California. These technologies leverage the creativity of the entertainment and game industries to create compelling immersive environments for training our soldiers. This training will increase the likelihood that soldiers sent into harm's way will accomplish their mission and safely return home.

Collaborative Technology Alliances. We recently established new partnerships with industry, universities, and other government agencies to harvest the fruits of fundamental research in five areas: advanced sensors, communications and networks, power and energy, advanced decision architectures, and robotics.

Objective Force Warrior. This is an integrated soldier system-of-systems approach to provide leap-ahead capabilities, with dramatic weight and power reduction, for the dismounted soldier. The goal is to attain seamless connectivity with other warfighters, weapon systems, and robotic platforms to achieve synergistic overmatch for full-spectrum operations.

Institute For Soldier Nanotechnologies. We plan to establish a university-affiliated research center to exploit the breakthrough potential of nano-engineered materials to provide leap-ahead objective force warrior capabilities. Nanoscience seeks to manipulate matter at the atomic scale, offering the potential for revolutionary materials with radically enhanced performance such as ballistic protection at a fraction of current weights and novel signature management techniques.

High-Energy Lasers. The Army S&T community is increasing investments to accelerate high-energy, solid-state laser technology options for potential application on the tactical battlefield. This effort seeks to identify the most promising solutions to ensure speed-of-light engagement and laser-weapon lethality.

Task Force

The Objective Force Task Force (OFTF) was established by the Army to facilitate the initial fielding of objective force capabilities by the end of this decade. LTG John Riggs was recently appointed as the OFTF Director. Under his leadership, the OFTF will integrate and synchronize all aspects of doctrine, training, leader development, organization, materiel and soldier related to the objective force.

Summary

The Army must have a diverse S&T portfolio that is responsive to current and future warfighter needs. The S&T community seeks technological solutions that can be demonstrated in the near term, explores the feasibility of new concepts for the midterm, and explores the imaginable for an uncertain far-term future.

Since the Army vision was announced in October 1999, the Army S&T effort has been reshaped and refocused to speed the development of those critical technologies essential to transform the Army into the objective force. The Army S&T community has accepted the technical challenges of transformation and has energized its resources to meet them.

DR. A. MICHAEL ANDREWS II is the Deputy Assistant Secretary of the Army for Research and Technology and Chief Scientist of the Army. Before coming to the Pentagon in 1997, Andrews was a senior executive at Rockwell International Corp. with leadership experience in technology development, business management, and strategic planning. He holds a Ph.D. in electrical engineering from the University of Illinois and M.S. and B.S. degrees in electrical engineering from the University of Oklahoma. He has 5 patents and 49 publications, and he is a recipient of Rockwell's Engineer of the Year Award.

DENNIS R. SCHMIDT is the Deputy Director for S&T Integration in the Office of the Deputy Assistant Secretary of the Army for Research and Technology. He has a B.S. in aeronautical science from Embry-Riddle Aeronautical University and an M.A. in business management from Central Michigan University.

DR. THOMAS KILLION is the Acting Deputy Director for Research in the Office of the Deputy Assistant Secretary of the Army for Research and Technology, on detail from the Army Research Laboratory. He has a Ph.D. in experimental psychology from the University of Oregon.
